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Wireline Whitepaper Draft

Rick Dudley and Sam Hart

February 20, 2020

Abstract

A. What problem does this system solve?
    i.   Sustainable development of open source software
    ii.   Unlocking P2P application service model
B. How this is done
    i.   P2P development stack & app marketplace
    ii.   Micropayment & service contract models
    iii. Equity funding via project tokens

Introduction

A. FOSS and tragedy of the commons
B. The success of SaaS businesses built on OSS demonstrates a sustainable OSS model is possible
C. P2P stack is necessary to generalize this funding model
D. Wireline as proposed solution

P2P Development Framework

DxOS SDK

DxOS is a framework for writing P2P applications.

[overview of modules]

Source code for applications built using DxOS may be stored in NPM or other external code hosting services. When a user wants to run an application, or a WCS node wants to run an application on a user's behalf, they can retrieve the source code from the external service, hash the source code, and verify the hash matches the one published in the WNS registry.

Alternatively, deterministically compiled application binaries, targeting specific architecture may be used and compared to matching hashes published in the WNS registry.

Non-deterministic binaries may also be delivered by providers who have been whitelisted by users.

Binaries from closed source applications may be distributed in this same fashion, however permissioned file sharing will be used to deliver proprietary objects. Sharing permissions will be provided by WNS's strong cryptographic identities. Application developers may also give users a list of trusted providers that can sign digitally sign distributed binaries on their behalf, as well as request proof of delivery.

Because the WQS stores data with proofs of integrity, one may also make source code or application binaries available via WQS.

EchoDB

EchoDB is an eventually consistent hierarchical object database, built on the Dat P2P file sharing protocol. It extends Dat to provide application-specific feeds and additional authentication functionality we call "Parties." EchoDB runs locally in your browser or in the node instance.

Applications consist of frontend components (Pads) and backend services (Bots), which interact as peers on the network. Peers exchange data by replicating feeds within a shared security domain called a Party. Each peer writes mutations as messages to an append-only log. The logs from each peer are combined into sets of logically partitioned datasets, which are manipulated by application-specific state machines.

Messages are received in order from individual peers, but peers may be randomly connected to each other. Therefore, at any moment each peer may have different sets of data from each other. In order to maintain consistency, applications implement state machines that generate a consistent data model. These state machines may be different for each application. Some applications may be composites of multiple state machines.

EchoDB is a personal database of hash-linked objects, including those originating from DxOS, WNS, or WQS. This unifying index allows an object in one feed to reference objects in another.

Hash-linked objects are arranged into application-specific feeds which can be retrieved by public key. EchoDB emits checkpoints

In EchoDB, a "Party" is analogous to a linux user group, in which read, write, and administrative privileges can be made to a shared data log. The log itself is an immutable record, however the canonical order is modifiable via Party permissions.

Example usage:

- A group of users, corresponding to a DxOS Party, use a group chat application together.
- One user with admin privileges registers a bot to perform spell check for the party.
- They could also register a bot and give it admin privileges, so other non-admins could write to the feed while the bot is away.
- In order to ensure all users can safely go offline without losing data, one user must checkpoint the party using WQS.
- To do so, they broadcast an open order and receive service offers with signed bond transactions, valid only if posted with the contract.
- They then select a service offer and add a WQS entry containing the service contract to the registry, along with their own bond and that of the provider.
- Then they send the checkpoint data to the WQS service provider.

The query service provides metered queries on the data. The bot actually stores the data i.e. a bot is a service that can join Parties.

[Expand on who within the party can attest to the checkpoint, how this works with multiwriter admin privileges]

EchoDB will run an associated daemon that tracks WNS, WQS, and Dat (party checkpointing and joining). This daemon provides a clean interface between these services.

Wirebox

I. Personal data store
II. Shared discovery and verification

Wirebox provides Wireline users with a persistent P2P data store.

Wireline Blockchain

Blockchain Construction

Issuance

1. Emission schedule & block reward - WIRE is ERC20 issued on Ethereum
2. Different holders have different redemption rights
3. For some users, WIRE is a...
    a. deposit receipt (voucher)

b.   share in an unregistered business trust (security)

A total of 1.5 Billion WIRE, the entire supply, will be issued on Ethereum as ERC20 tokens prior to network genesis.

Initial allocations will be specified within the issuance contract, after which all tokens will be transferred to a Gateway Ethereum contract. The Gateway contract will specify redemption rights and conditions for each class of token holders, as well as the testnet and block reward pools.

Below is a table of token allocations at issuance, along with redemption rights:

Holder	Number of Tokens	Fraction of Tokens	Redemption Cond.
Team	112500000	7.5%	After 12 months, unlocked in equal proportion monthly for following 9 years. First year only permits signed delegation.
SAFT	300000000	20%	After 12 months, unlocked in equal proportion monthly for following 9 years. First year only permits signed delegation.
Foundation	543750000	36.25%	Unlocked each epoch, 10000000 on first epoch, decrementing by 190000 until supply has been depleted
Block Reward Pool	543750000	36.25%	Unlocked each epoch, 10000000 on first epoch, decrementing by 190000 until supply has been depleted
Testnet	not in implemented in current supply schedule	0%	NA

The Wireline blockchain validator set manages the gateway contract and unlock process via multisig that exists on both Ethereum and the Wireline blockchain.

Sidechain

Wireline will use an optimistic rollup construction for its blockchain, inheriting security from the Ethereum blockchain. Wireline will use Tendermint consensus and its own validator set to come to agreement on the execution order of all Wireline transactions. Rollup commitments are then made to Ethereum, resulting in a sidechain architecture.

The Wireline blockchain node binary will have multiple modules that may be enabled or disabled and run on the same p2p network. Validators for one module need not be validators for others. If validators choose to validate multiple modules they will use the same bonding address for validation of all modules, i.e. validators share the same bonding UTXO set. Consensus is formed on each module and sub-blocks from each module are then ordered within the committed block in a predetermined sequence.

Validators can individually choose to not offer service for legal reasons or otherwise, however the sidechain system maintains censorship resistance by allowing users to route around validators unwilling to mine their transactions. As a last-resort, users may exit the rollup and recover any funds locked on their behalf, up to the most recent rollup submitted to the Ethereum blockchain.

Vouchers

The optimistic rollup contract on Ethereum allows users to lock vouchers in the gateway contract and generate an equivalent voucher UTXO within the sidechain. We will define voucher as a bearer cryptographic asset that can be redeemed for an escrowed asset on another chain.

Individuals may lock WIRE, purchased on the exchange of their choice, Ethereum, or one of several ERC-20 stablecoins. All ERC-20 tokens must first be whitelisted by the Wireline governing body (composed of all WIRE holders) in order for 1-to-1 voucher issuance to occur. When new tokens are whitelisted, a new escrow contract is deployed to Ethereum by the Wireline multisig using a standard factory contract. All escrow contracts are controlled by the Wireline governance system and may be deactivated at the discretion of WIRE token holders.

Tokens may be in one of three states:

1. Ethereum-native ERC-20
2. Voucher UTXO, in which native tokens are locked in the gateway contract
3. State channel token, in which tokens are either locked using HTLC on the Ethereum blockchain or on the Wireline blockchain

For WIRE holders, this state determines the legal status of the asset:
1. ERC-20, share in an unregistered business trust (security)
2. Voucher UTXO, deposit receipt
3. State channel token, deposit receipt

VDF challenge

1. What?
2. Why?
   a. Fixed supply of tokens
   b. Forces token holders to actively participate

The Wireline staking mechanism strives to have every token holder be an *active* participant in the network while ensuring strict conservation of token supply. Thus, all WIRE tokens should be locked for staking within the network—unless intentionally unstaked in advance of transactional action. To determine whether unstaked coins are truly "active," a unique VDF (Verifiable Delay Function) challenge will be issued to every unstaked UTXO at the beginning of each epoch. Additionally, delegation has an expiration of one epoch for this same purpose, to ensure users delegating tokens continue to remain active.

A valid response to the VDF challenge will exempt all corresponding tokens from penalization. Anyone may submit a valid unsigned response to any challenge in order to preserve plausible deniability of token holders. Of the remaining inactive pool, a token-weighted random draw will determine a subset of assets, to be destroyed. A new set of tokens, equal to 5% of the WIRE destroyed, are then issued to the validation reward pool and redistributed at the next epoch.

From a system level, the value of having multiple types of scalar faults is users of the network (validators and users) are allowed to programmatically exit based on certain criteria. In this sense it does meaningfully improve security to have these messages visible on-chain.

Wireline Blockchain Validation Rules

By owning tokens, WIRE holders are eligible to delegate their stake toward the consensus validation process and thereby receive a share of the block reward, paid in WIRE. Validators may then stake WIRE tokens on behalf of holders in exchange for a commission, priced and denominated through an independent arrangement between the two parties. Any staked tokens are subject to forfeiture in accordance with protocol slashing conditions, whereupon the slashed tokens will be burned. In the event of fraud, new tokens will be minted, equal to a 5% of those slashed, and distributed to whomever supplied evidence of wrongdoing.

CDPs to create WUSD

WUSD is a stablecoin used to pay for services via the Wireline Payments Service (WPS). WUSD is a collateralized synthetic, targeting the United States Dollar (USD), which represents a claim against other cryptographic assets. Collateral assets will include WIRE, Project tokens collateralized by WIRE, and cryptographic assets bridged from external blockchains, such as ETH, together with a diversified basket of stablecoins. The initial set of collateral assets is still under review and subject to change prior to deployment. Issuance of WUSD will be permissionless, with collateralization ratios equilibrated economically via programmatic supply curves in response to price feeds and curve parameters secured by Wireline Governance.

Wireline's price oracle will be established as a median of independent exchange rates between USD and all other collateral assets, written periodically to the Wireline blockchain by a set of exchange rate providers, whose membership will be determined by WIRE holders. The Wireline price oracle will be secured by a failsafe global liquidation mechanism which may be triggered by any WIRE holder or price feed provider. Once stabilized, Wireline's stablecoin contracts may migrate to using a market-based price oracle, determined via the median of multiple USD-targeted stablecoins. Such a change would be determined by Wireline Governance.

Users who wish to use WUSD without monitoring their collateralization ratio may buy WUSD in a peer-to-peer fashion, or exchange assets via the Wireline exchange's automatic order routing.

Delegators must submit a re-delegation transaction once per epoch to ensure continued participation. Users will undelegate / unstake tokens as needed in order to pay ORU transaction fees, registry fees, to open CDPs, or interact with the Wireline exchange. WIRE acts as an intrinsic discount token because transaction fees must use WIRE, thus all other tokens will have a transaction premium. Any "passive users" should be holding WUSD stablecoins, corresponding CDP holders will then delegate the collateralized WIRE instead of WUSD holder.

NOTE: Any WIRE can be used by its owner for governance purposes i.e. if they have CDP position, staked in registry, etc.

ex_net order curves and batch auctions

[see ex_net paper]

Payments (WPS)

[see payment paper]

Registration (WNS)

1. Identity / reputation
2. Software distribution
   a. Open source - git/radicle
   b. Closed source/trusted execution environments
3. Naming
   a. Purchasing
   b. Auctions

Identity and Reputation

Wireline's reputation is bi-lateral and applies to any registered name within the Wireline Name Service. When a transaction occurs between Alice & Bob, the only people who they aren't sybil are Alice & Bob themselves. The only way to know the honest delivery of real service is bi-lateral agreement between both parties.

Identities are bootstrapped via a scarce invite system. Participants invite their friends who act as their initial trust anchors. Conversely, an individual who wants to join the network but doesn't yet have an invite will ask their trusted friends.

When a new person enters the network, they receive a cryptographically deniable claim of who the person inviting them has interacted with. New users will thus get oriented through an initial set of recommendations from the existing user's address book.

Faucet

The Wireline Foundation will run a faucet for registration that allows users to submit a VDF proof to get an initial set of funds to register a name. The faucet will be rate-limited and cap individual contributions.

Registered names (or identities) which will consist of hashed, human-readable strings, may be verified or unverified depending on the registration source and how they intend to be used. Oauth linking, similar to Keybase, where users can attach non-crypto social accounts is a potential avenue for identity verification and should be explored further.

Auctions and Renewal

The WNS protocol will coordinate auctions for exclusive leases on Wireline names.

The name registration process starts by escrowing a minimum of ___ WIRE, corresponding to a pro-rated 1 year lease of the namespace. Names may be renewed at a flat epoch rate for a duration of the name-holder's choosing by adding funds to the escrow associated with that name. If escrow funds run out, the lessee must re-register within a grace period of 2 days. Failure to do so will result in the name going up for auction. If no one bids in this auction, the name remains available for registration.

WNS will use a Sealed Vickrey Clarke Groves auction, with a commit reveal length of 2 days. The first auction for a name will incur an additional registration cost in order to cover the auction fee for unregistering.

If lessee's chose to close out their escrow, their funds will remain locked for the original duration, however the name will be released immediately and their funds will be returned at the end of the original lease period.

Funds may be purchased and managed by multiple accounts using an in-built multi-sig construct, however multi-sig signers must have unanimous consent to transferring or closing the account, after which remaining funds are divided evenly among all parties.

It is important to note that registering a name is a lease on that name for a specific time period (@head) as pointers may still exist to registration information from previous owners.

Registration will start with a single subdomain and then progressively allow for more TLDs. Registrants may also claim a name by posting a specific TXT record on their DNS.

WNS validators will run a DNS-sec validated cache to ensure WNS DNS matches global DNS records according to DNS root authority trust model.

WQS

Payment channel integration

The Wireline Query service provides data availability via bonded service contracts, and integrity guarantees via IPLD proof.

Users will publish data and pay providers to make that data available, signing chunks of data before they are stored and receiving signed chunks in return. Providers must put up a bond in order to register as a provider and upon accepting a service contract, at which point the two parties establish a payment channel.

Redundancy is ensured by contracting multiple service providers. Any providers who do not submit receipts can be punished. Providers will give receipts, even if an error occurs in their processing. If the provider fails to provide a receipt, then the user can either query another server or punish the provider by posting a message on-chain. Conversely, if contract setup fails, the publisher will lose their deposit.

WES

1. Wireline Network Validators ex_net order book
2. Regulatory structure

The Wireline Exchange Service is a federated exchange for trading cryptographic assets within the Wireline Network. Anyone may permissionlessly offer WXS services, at which point WXS service providers will have the responsibility to monitor trades and list or delist token pair offers in compliance with appropriate jurisdictional regulations.

Core WES functionality includes the following:

- Margin call auctions for WUSD, i.e. "Collateralized Debt Positions"
- Purchase of project tokens using WIRE, WUSD, or exogenous stablecoins
- "Order curves" corresponding to service agreements settled via state channel

Project token issuers will be responsible for collecting AML/KYC for all token holders and managing a whitelist which will be made available to WES providers, permitting them to fill

exchange orders. AML/KYC information collection and compliance may also be outsourced to a third party contracted service.

WIRE holders may choose to allow the registration of Project equity tokens, debt, or derivatives, however to facilitate the transaction of these instruments, members of the WXS Federation will be required to register as broker-dealers, in accordance with local regulations. WUSD may be subject to money transmission laws, and in such cases WXS Federation members facilitating the transmission must register as money transmitters, per local regulations.

The WXS will act as a backend currency conversion system, allowing payments denominated in WUSD, or other tokens, to be exchanged for WIRE upon delivery of payment to service providers. As such, end-users will have access to a simple and convenient payment interface, while ensuring all transactions contribute to the security of the network. Because all Wireline transactions must be paid in WIRE, transactions fees denominated in WIRE are expected to be offered at a discount with respect to other tokens. Similarly, transactions denominated in WUSD should reduce transaction costs associated with price variability, while being the most easily convertible into WIRE. Thus it is expected that typical service payments will be denominated in WUSD unless a service opts to attract liquidity by offering their services at a discount in exchange for Project tokens.

WCS

1. Compute Marketplace
2. Content addressable data and payments
3. Compute oracle
4. Signed service messages with registered identity

The Wireline Compute Service (WCS) is a distributed network of compute service providers which may be contracted to perform run microservices.

WCS contracts are initiated when application users broadcast an open order to the network and select a provider. Orders contain the following:

- Reference to WNS entry where data is located
- Description of the job
- Contract length and conditions

To initiate the contract each party places a WIRE bond in escrow. The client's bond is paid out progressively to the provider. The provider's funds are used as collateral in the event contract terms are breached.

Because computation may be non-deterministic, and host availability cannot be guaranteed by the Wireline network, assurances of computational integrity can only be made if users verify the same computations themselves, or contract a separate entity to do so. In this way application users and providers exchange services for fees in a tit-for-tat fashion, where computational integrity is ensured with similar assurances to traditional VPS services. If users find a problem with their service, they have the choice to discontinue their WCS contract and use another provider.

Once a user and provider enter into a service agreement a bearer token is issued to the user, which can be redeemed in exchange for services: authorization to access compute resources and data stored as part of contracted services.

A "bot" is a single standalone application microservice instance running within its own hosted environment. Bots are stateful and have an explicit IP location recorded as part of the WNS service offer.

Bots can be assigned revocable bearer tokens, which they may use autonomously for Party authentication, signing messages, and submitting transactions to the blockchain (used, for example, to checkpoint a Party). In this way bots may participate in parties just as human users would, in order to provide in-situ services (ex. Spellcheck services). With the requisite credential, bots may also spawn new bots and manage their lifecycle using a factory scheme.

Launchpad

[Text should be developed in collaboration with Launchpad development team]

Fundraising

    A. Legal
        a. Project token issuing body legal structure
        b. Legal status of project tokens themselves
            i. Simple registration because service is already running tokens will most likely not be securities IANAL
        c. KYC requirements
    B. Why Project Tokens? (in plain english)
        a. For projects
        b. For early supporters
        c. For users
    C. Mechanism description

       a. Uses WIRE
       b. Bonding curve/Balancer/liquidity proofs
       c. Early supporters benefits

By asking users to be early participants in a product they recognize has traction, they are effectively pre-paying for service and then getting more of the service in the end because they pre-paid.

Analogy: buying bus tickets and then in the future one ticket buys 10 rides instead of one. Ticketmaster and adwords work in a similar fashion, where auctions for service are not securities.

This amounts to a new distribution channel for open source software developers and a new way to fund that development.

For end users, this may result in several salable advantages, including:

- More private app usage (data is no longer sold)
- Because revenue model changes, this changes what kind of products get made

More specifically, the life cycle of this project fundraising process looks like the following:

1. Developers publish their source code and create a WNS entry referencing the published repo. This repo will contain code used to provide network services.
2. An initial instance of the service is deployed by the developers, i.e. the "Developer's Instance."
3. Developers attract the attention of investors, either via personal interactions with developers, or with material changes to the code base or updates to the blockchain, commit velocity, for instance.
4. Developers and investors will then decide how the initial offering should be structured by choosing from a menu of pre-existing templates (or creating their own structure). It's important to note that discussion of the offering happens *after* the code has already been published and the developers have operated the first instance of the service. At this point the developer's instance is already being used by end users and those users are exchanging WUSD for access to the service.
5. A Balancer project treasury contract is then specified, which includes several parameters, specific to the project's needs:
    - n developers get tokens in an initial "pre-mine" distribution
    - Which assets the balancer accepts and in what proportion
    - The initial Balancer governance parameters
    - Feature and verifiable usage milestones (when milestones are hit, the balancer releases assets from the curve to developers)

6. The balancer instance is then deployed, after which investors buy into the curve. Depending on the specific service mechanism, the balancer maintains the WUSD price of service while adjusting the WUSD|ST price and the ST|Service price such that ST holders get discounted service. Everyone must now access the service via the ST instead of WUSD, this transition is made seamless by the balancer.

Governance

1. Unregistered business trust
2. Various forms of on-chain voting for various parameters.

The Wireline Blockchain will adopt a model analogous to corporate governance with on-chain voting, see https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3082915